

(A-69991/RMA)

**SYSTEM AND METHOD FOR INTELLIGENTLY SCALING MESSAGE PROCEDURE/DATA SETS
TO ADAPT THE PROCEDURE/DATA SETS TO RECEIVER ATTRIBUTES AND MAINTAIN
MESSAGE INTENT**

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I Claim:

1. A method for scaling a data set, said method comprising steps of:

performing a first attribute scaling of a message when preparing and before transmission of said message to a client device based on receiver client attributes and a priori sender knowledge of receiving client device and user preferences;

performing a second procedural scaling of said message including executing capability determining procedures embedded within said message after message preparation, message transmission, and message receipt, that determine receiver client capability attributes and select a particular message expression from a plurality of message expressions and element selection available in said received message; and

performing a third hardware abstraction layer scaling of said particular selected message expression to adapt said selected message expression for presentation on said client device.

2. The method in claim 1, wherein said receiver client attributes are selected from the group consisting of: a message language preference, a message security preference, a message size constraint, connection speed, audio rendering capabilities, video rendering capabilities, device memory size, device memory availability, device CPU limitations, user nationality, playback engine version or capabilities; and combinations thereof.

3. The method in claim 1, wherein said receiver client attributes include a communication link connection speed determined substantially during preparation of said message either (i) prior to transmission of said message, or (ii) after initiation of transmission but prior to completion of transmission of said message.

4. The method in claim 2, wherein said receiver client attributes further include a communication link connection speed determined substantially during preparation of said message either (i) prior to transmission of said message, or (ii) after initiation of transmission but prior to completion of transmission of said message.

5. The method in claim 1, wherein said receiver client attributes are selected from the group consisting of: a speed attribute of a processor within said client device, an available memory attribute of a memory device connected to said processor, an audio capability attribute, a video capability attribute, and combinations thereof.

6. The method in claim 5, wherein said video capability attribute includes attributes for screen size, monochrome or color display capability, number of monochrome gray scale levels, number of presentable colors, color palate, and combinations thereof.

7. The method in claim 1, wherein said procedural determinations include, when an audio message expression is included within said plurality of message expressions, determining whether said client has specific audio presentation capabilities, and when said client does not have a suitable audio presentation capability, selecting a text message expression in place of said audio message expression.

8. The method in claim 1, wherein said procedural determinations include, when first message expression is included within said plurality of message expressions, determining whether said client has a first message type presentation capability, and when said client does not have said first message type presentation capability, selecting an alternate message type expression in place of said first message type expression while still maintaining the intent of said message.

9. The method in claim 8, wherein said alternate message type is selected from a plurality of alternate message types for said first message type according to predetermined rules and on said client message type presentation capabilities.

10. The method in claim 9, wherein said predetermined selection rules include selecting a text type alternative message when a client does not have any of an audio message type presentation capability, a video message type presentation capability, an audio-video message type presentation capability, a graphic message type presentation capability, or a photographic message type presentation capability.

11. The method in claim 9, wherein said predetermined selection rules include a hierarchical selection preference that selects the message presentation type that provides a maximum available amount of information possible for said client device.

12. The method in claim 11, further including selecting the message presentation type using semantic information about the elements.

13. The method in claim 11, wherein said hierarchical selection preference selects a message presentation type in the order of decreasing preference from highest preference to lowest preference as follows: (i) multi-media including audio and motion video content; (ii) multi-media having audio and still graphic imagery content; (iii) motion video without audio; (iv) still graphic without audio; (v) audio; and, (vi) text.

14. The method in claim 12, wherein said hierarchical selection preference selects a message presentation type in the order of decreasing preference from highest preference to lowest preference as follows: (i) multi-media including audio and motion video content; (ii) multi-media having audio and

still graphic imagery content; (iii) motion video without audio; (iv) still graphic without audio; (v) audio; and, (vi) text.

15. The method in claim 9, wherein said predetermined selection rules include a hierarchical
5 selection preference that selects the message presentation type to be a text or symbolic message presentation type when said client device does not support other message presentation types.

16. The method in claim 9, wherein said hierarchical rules are altered by a user preference.

10 17. The method in claim 16, wherein said user preference includes a user preference identifying a user of said client device as sight impaired, and providing an audio message format type in preference to video, graphic, or text message presentation types.

15 18. The method in claim 1, wherein said step of performing a third hardware abstraction layer scaling of said particular selected message expression comprises adapting a two-dimensional graphical display device having display device characteristics to display a graphical data set that does not exactly match said display device characteristics.

20 19. The method in claim 18, wherein said graphical data set has dimensions larger than can be simultaneously displayed by said graphical display device, and said adapting comprises reducing said graphical data set so that all elements of said graphical data set can be simultaneously displayed.

25 20. The method in claim 18, wherein said graphical data set has dimensions smaller than will fill an available display dimension, and said adapting comprises magnifying said graphical data set so that available elements of said graphical data set fill at least one dimension of a two-dimensional display.

30 21. The method in claim 18, wherein said graphical data set has dimensions larger than can be simultaneously displayed by said graphical display device, and said adapting comprises providing at least the functionality of one scroll bar so that a user of said client device may sequentially scroll through different regions of said graphical data set.

22. The method in claim 21, wherein said at least one scroll bar includes the functionality of a horizontal scroll bar and a vertical scroll bar.

35 23. The method in claim 1, wherein said step of performing a third hardware abstraction layer scaling of said particular selected message expression comprises adapting an audio playback device having audio playback device characteristics to playback an audio data set that does not exactly match said audio playback device characteristics.

24. The method in claim 21, wherein said audio data set has a larger frequency range than can be reproduced by said audio playback device, and said adapting comprises reducing the frequency content of said audio data set so that said audio data set can be reproduced by said audio playback device.

25. The method in claim 1, wherein said step of performing a third hardware abstraction layer scaling of said particular selected message expression comprises adapting an audio characteristic to represent an audio data set that does not exactly match audio characteristics of said client device.

26. The method in claim 25, wherein said adaptation is selected from the group of adaptations consisting of: speeding up playback while reducing frequency to maintain normal sound pitch characteristics; changing a mono audio characteristic to a stereo characteristic, changing a stereo characteristic to a mono characteristic, changing an n-dimensional audio characteristic to an m-dimensional sound characteristic where m and n are any integers, moving sound around spatially, creating three-dimensional (3D) sound or audio effects, generating particular predetermined or variable acoustic effects to simulate different sound or acoustical venues or environments, eliminating periods of audio silence, eliminated periods of particular predetermined audio characteristics, filtering and removing background noise, filtering to remove particular frequencies, filtering to enhance particular frequencies, speeding up audio reproduction, slowing down audio reproduction, adapting audio to a particular persons hearing range frequency and/or volume, blending audio or sounds, normalizing output level for hearing impaired person, filtering to enhance high-frequency components for older persons, generating special versions of voice, performing karaoke filtering to suppress voice components of audio but retain music, and any combination thereof.

27. The method in claim 23, wherein said adaptation comprises performing a sample rate conversion so that a device that does not supports all sample rates uses software and/or hardware to convert sample rate.

28. The method in claim 1, wherein said step of performing said hardware abstraction layer scaling comprises adapting said message expression to match said client device hardware characteristics.

29. The method in claim 18, wherein said graphical data set is a three color graphical data set and said graphical display device is a monochrome display device, and said adapting comprises transforming said three color graphical data set to match the number of gray scale levels of said monochrome graphical display device.

30. A method for scaling a procedure/data set, said method comprising steps of:

performing a first attribute scaling of a message when preparing and before transmission of said message to a client device based on receiver client attributes;

performing a second procedural scaling of said message including executing capability determining procedures embedded within said message after message preparation, message

transmission, and message receipt, that determine receiver client capability attributes and select a particular message expression from a plurality of message expressions available in said received message; and

performing a third hardware abstraction layer scaling of said particular selected message expression to adapt said selected message expression for presentation on said client device;

said receiver client attributes are selected from the group consisting of: a message language preference; playback engine software version number; software playback engine capabilities; a message security preference; a message size constraint; a speed attribute of a processor within said client device; an available memory attribute of a memory device connected to said processor; an audio capability attribute; a video capability attribute including video attributes for screen size, monochrome or color display capability, a number of monochrome gray scale levels or a number of presentable colors and color palate; a communication link connection speed determined substantially during preparation of said message either (i) just before preparation while said communication link is still open; (ii) prior to transmission of said message, or (iii) after initiation of transmission but prior to completion of transmission of said message; and combinations thereof; and

said procedural determinations include, when first message expression is included within said plurality of message expressions, determining whether said client has a first message type presentation capability, and when said client does not have said first message type presentation capability, selecting an alternate message type expression in place of said first message type expression while still maintaining the intent of said message; said alternate message type is selected from a plurality of alternate message types for said first message type according to predetermined rules and on said client message type presentation capabilities; said predetermined selection rules include a hierarchical selection preference that selects the message presentation type that provides a maximum available amount of information possible for said client device; said hierarchical selection preference selects a message presentation type in the order of decreasing preference from highest preference to lowest preference as follows: (i) multi-media including audio and motion video content; (ii) multi-media having audio and still graphic imagery content; (iii) motion video without audio; (iv) still graphic without audio; (v) audio; and, (vi) text.

31. The method in claim 30, wherein said hierarchical rules are overridden by a user preference.

32. The method in claim 31, wherein said user preference includes a user preference identifying a user of said client device as sight impaired, and providing an audio message format type in preference to video, graphic, or text message presentation types.

33. The method of claim 31, wherein for hearing impaired person audio is converted into text and the text is may be rendered so that the text flashes on the screen all at once, so that the text appears sequentially on the screen or scrolls on the screen, or so that the text is animated in some way to moves around the screen in some way and thereby avoid covering other text or information on the screen.

34. The method in claim 30, wherein said step of performing said hardware abstraction layer scaling comprises adapting said message expression to match said client device hardware characteristics.

35. The method in claim 30, wherein said step of performing a third hardware abstraction layer scaling of said particular selected message expression comprises adapting a two-dimensional graphical display device having display device characteristics to display a graphical data set that does not exactly match said display device characteristics.

36. The method in claim 35, wherein said graphical data set has dimensions larger than can be simultaneously displayed by said graphical display device, and said adapting comprises either: (i) reducing said graphical data set so that all elements of said graphical data set can be simultaneously displayed, or (ii) providing at least the functionality of one scroll bar so that a user of said client device may sequentially scroll through different regions of said graphical data set.

37. The method in claim 30, wherein said graphical data set is a three color graphical data set and said graphical display device is a monochrome display device, and said adapting comprises transforming said three color graphical data set to match the number of gray scale levels of said monochrome graphical display device.

38. A method for scaling a data set, said method comprising steps of:
performing a client attribute scaling of a message when preparing said message before communicating said message to a client device based on receiver client attributes; and
performing a procedural scaling of said message within said client device including executing capability determining procedures embedded within said message after message preparation, message communication, and message receipt by said client, that determine receiver client capability attributes and selecting a particular message expression from a plurality of message expressions available in said received message.

39. The method in claim 38, said method further comprising step of:
performing a third hardware abstraction layer scaling of said particular selected message expression to adapt said selected message expression for presentation on said client device.

40. A method for optimizing content sent to a client device for a user that minimizes transmission bandwidth while maintaining the intent of the content, said method comprising:

scaling the content (story) by the producer (composer engine) producing the content so that the data and procedural aspects of the content are scaled to match anticipated attributes of the target client device and user preferences at the time of composing said content;

scaling the content by the story during execution of procedural content (instructions) to match the capability of the client device after the content is received by the client device; and

scaling the content by the hardware abstraction layer to match client device specific characteristics to enable playback of the content on the client device.

5 41. The method in claim 40, wherein said hardware extraction layer scaling includes the steps of:
comparing the hardware resources required to perform an action requested by the story
procedure executing in the client with the hardware resources available in the client device; and
performing a substitute action for said requested action if the available hardware does not permit
performing the requested action

10 42. The method in claim 41, wherein said substitute action is selected from the group of actions
consisting of:

- (a) substituting an alternative content of a different content type for the requested content;
- (b) modifying the manner in which the requested content is presented to the user; and
- (c) modifying the requested content so that it can be presented to the user in its modified form.

15 43. The method in claim 42, wherein the content is a digital image and said digital image is too large
to be displayed as a single image on the client device; and said substitute action is selected from the
group consisting of: substituting a text description of the image for the image, displaying a portion of the
image and providing the functionality of scroll bars so that the user may interactively scroll to different
20 portions of the image viewing only a portion of the image at a time, decimating pixels of the image to
reduce the size of the image to fit within the display area of the device display, processing the image to
reduce the size of the image to fit within the display area of the display device, substituting a smaller
image, and combinations thereof.

25 44. The method in claim 43, wherein the content is an audio content and said client device does not
provide audio content playback capabilities, said substitute action comprises substituting a text
description of the audio content.

30 45. The method in claim 43, wherein the content is an image or video content and said client device
does not provide imagery or video content playback capabilities, said substitute action comprises
substituting a text description of the imagery or video content.

35 46. The method in claim 43, wherein the content is a text content and attributes of the client or the
user indicate that the user is a blind individual and said client device provides audio output and
text-to-speech conversion, said substitute action comprises performing a text-to-speech conversion of
said text description to generate an audio content.

47. A computer program product for use in conjunction with a computer system, the computer
program product comprising a computer readable storage medium and a computer program mechanism

embedded therein, the computer program mechanism, comprising: a program module that directs components of said computer system to scale a data set, the program module including instructions for:

performing an attribute scaling of a message when preparing and before transmission of said message to a client device based on receiver client attributes and a priori sender knowledge of receiving client device and user preferences.

48. The computer program produce in claim 47, wherein said program module further includes instructions for performing a procedural scaling of said message including executing capability determining procedures embedded within said message after message preparation, message transmission, and message receipt, that determine receiver client capability attributes and select a particular message expression from a plurality of message expressions and element selection available in said received message.

49. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs components of said computer system to scale a data set, the program module including instructions for:

performing a procedural scaling of a message including executing capability determining procedures embedded within said message after message preparation, message transmission, and message receipt, that determine receiver client capability attributes and select a particular message expression from a plurality of message expressions and element selection available in said received message.

50. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs components of said computer system to scale a data set, the program module including instructions for:

performing a hardware abstraction layer scaling of said particular selected message expression to adapt said selected message expression for presentation on said client device.

51. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs components of said computer system to scale a data set, the program module including instructions for:

performing a client attribute scaling of a message when preparing said message before communicating said message to a client device based on receiver client attributes; and

performing a procedural scaling of said message within said client device including executing capability determining procedures embedded within said message after message preparation, message communication, and message receipt by said client, that determine receiver client capability attributes

and selecting a particular message expression from a plurality of message expressions available in said received message.

52. A computer program product for use in conjunction with a computer system, the computer program product comprising a computer readable storage medium and a computer program mechanism embedded therein, the computer program mechanism, comprising: a program module that directs components of said computer system to optimize content sent to a client device for a user that minimizes transmission bandwidth while maintaining the intent of the content, the program module including instructions for:

scaling the content by the producer producing the content so that the data and procedural aspects of the content are scaled to match anticipated attributes of the target client device and user preferences at the time of composing said content;

scaling the content by the story during execution of procedural content to match the capability of the client device after the content is received by the client device; and

scaling the content by the hardware abstraction layer to match client device specific characteristics to enable playback of the content on the client device.

53. A system for scaling a message data set, said system comprising:

an attribute scaler performing a first attribute scaling of a message when preparing and before transmission of said message data set to a client device based on receiver client attributes and a priori sender knowledge of receiving client device and user preferences;

a procedural scalar performing a second procedural scaling of said message data set including means for executing capability determining procedures embedded within said message after message preparation, message transmission, and message receipt, to determine receiver client capability attributes and to select a particular message expression from a plurality of message expressions and element selection available in said received message; and

a hardware abstraction layer scalar scaling said particular selected message expression to adapt said selected message expression for presentation on said client device.

54. The system in claim 53, wherein said attribute scalar comprises computer program code executing within a processor and memory coupled to said processor in a general purpose computer.

55. The system in claim 53, wherein said procedural scalar comprises computer program code executing within a processor and memory coupled to said processor in a client information appliance.

56. The system in claim 53, wherein said hardware abstraction layer scalar comprises computer program code executing within a processor and memory coupled to said processor in a client information appliance.